CLAIMS

What is claimed is:

1. A method for determining a projected area of an edge in a pixel, the edge being along a major direction, the pixel being part of a scan line, the method comprising:

setting the projected area equal to a unit area projected by the edge in one unit step along the major direction across one pixel;

determining if the edge is at a starting point located inside the pixel;

if the edge is at a starting point located inside the pixel:

determining a first excessive area attributable to a first portion of the unit area located before the starting point;

decrementing the projected area in the pixel by the first excessive area;

determining if the edge is at an end point located inside the pixel;

if the edge is at an end point located inside the pixel:

determining a second excessive area attributable to a second portion of the unit area located after the end point;

decrementing the projected area by the second excessive area.

2. The method of claim 1, wherein said determining if the edge is at a starting point located inside the pixel comprises:

determining a first distance along the major direction from a current position of the edge to a pixel border along a minor direction that the edge is traveling away from;

wherein the edge is at a starting point located inside the pixel if the first distance is not equal to 0.

3. The method of claim 2, wherein said determining a first excessive area comprises:

determining a second distance along the minor direction from the current position of the edge to a y-intercept of the pixel border;

if the edge is going right, calculating the first excessive area as follows:

$$area0 = dy0 - \frac{dx0 \times dy0}{2},$$

wherein area0 is the first excessive area, dx0 is the first distance, and dy0 is the second distance;

if the edge is going left, calculating the first excessive area as follows:

$$area0 = \frac{dx0 \times dy0}{2}.$$

4. The method of claim 1, wherein said determining if the edge is at an end point located inside the pixel comprises:

determining if a first distance along the major direction from a current position of the edge to a pixel border along the minor direction that the edge is traveling towards is equal to 0;

wherein the edge is at an end point located inside the pixel if the first distance is not equal to 0.

5. The method of claim 4, wherein said determining a second excessive area comprises:

determining a second distance along the minor direction from the current position of the edge to a y-intercept of the border;

if the edge is going right, calculating the second excessive area as follows:

$$area1 = \frac{dx1 \times dy1}{2},$$

wherein area1 is the second excessive area, dx1 is the first distance, and dy1 is the second distance;

if the edge is going left, calculating the second excessive area as follows:

$$area1 = dy1 - \frac{dx1 \times dy1}{2}.$$

6. The method of claim 1, further comprising:

incrementing the projected area by a carryover area in the pixel, wherein the carryover area is an area projected onto the pixel by a portion of the edge in a previous pixel.

7. The method of claim 6, wherein the carryover area is calculated as follows:

carryover_area += dy,

where carryover_area is the carryover area, += is a function that increments carryover_area by dy, and dy is a distance along the minor direction between the positions of the edge in the previous pixel and the pixel.

8. The method of claim 6, further comprising:

traveling along the edge in one unit step along the major direction to a second pixel that the edge touches;

determining if the second pixel is in a second scan line;

if the second pixel is not in a second scan line:

calculating a distance along the major direction from a current position of the edge to a pixel border along the minor direction that the edge is traveling towards if the second pixel is the last pixel that the edge touches;

calculating a second carryover area in the second pixel, wherein the second carryover area is a second area projected onto the second pixel by a second portion of the edge in the pixel.

9. The method of claim 8, wherein the second carryover area is calculated as follows:

carryover_area += dy,

where carryover_area is the carryover area, += is a function that increments carryover_area by dy, and dy is a distance along the minor direction between the positions of the edge in the pixel and the second pixel.

10. The method of claim 6, further comprising:

traveling along the edge in one unit step along the major direction to a second pixel that the edge touches;

determining if the second pixel is in a second scan line;

if the second pixel is in a second scan line:

determining an exceeded area projected by a portion of the edge in the second pixel;

decrementing the projected area of edge in the pixel by the exceeded area.

11. The method of claim 10, further comprising:

if the second pixel is in a second scan line, saving the exceeded area as a second projected area of the edge in the second pixel.

12. The method of claim 11, further comprising:

if the second pixel is in a second scan line:

calculating a second carryover area projected by a portion of the edge in the second pixel onto a third pixel in the second scan line; and

saving the second carryover area.

13. The method of claim 1, further comprising setting the projected area equal to an exceeded area if the exceeded area has been previously determined, wherein the exceeded area is an area projected by a portion of the edge in the pixel when the edge travels in one unit step along the major direction from a previous pixel in a previous scan line to the pixel in the scan line.

14. A method for determining a projected area of an edge in a pixel, the edge being along a major direction, the pixel being part of a scan line, the method comprising:

setting the projected area equal to a unit area projected by the edge in one unit step along the major direction across one pixel;

if the edge is at a starting point located inside the pixel, decrementing the projected area in the pixel by a first excessive area not attributable to the edge;

if the edge is at an end point located inside the pixel, decrementing the projected area by a second excessive area not attributable to the edge;

incrementing the projected area by a carryover area in the pixel, wherein the carryover area is an area projected onto the pixel by a portion of the edge in a previous pixel;

traveling along the edge in one unit step along the major direction to a second pixel that the edge touches;

if the second pixel is not in a second scan line:

calculating a distance along the major direction from a current position of the edge to a pixel border along the minor direction that the edge is traveling towards if the second pixel is the last pixel that the edge touches;

calculating a second carryover area in the second pixel, wherein the second carryover area is a second area projected onto the second pixel by a second portion of the edge in the pixel;

if the second pixel is in a second scan line:

determining an exceeded area projected by a portion of the edge in the second pixel;

decrementing the projected area of edge in the pixel by the exceeded area;

saving the exceeded area as a second projected area of the edge in the second pixel;

calculating and saving a second carryover area projected by a portion of the edge in the second pixel onto a third pixel in the second scan line.

15. A method for rendering a graphic file, comprising:

approximating a curved edge with a plurality of first straight edges, said approximating comprising:

dividing a curved edge into a first curved edge and a second curved edge;

determining if a flatness of a first straight edge between a first anchor point and a second anchor point of the second curved edge is less than a threshold;

if the flatness is less than the threshold:

replacing the second curved edge with the first straight edge;

repeating above steps by setting the first curved edge as the curved edge;

if the flatness is greater than the threshold, repeating the above steps by setting the second curved edge as the curved edge;

determining a projected area of a second straight edge in a first pixel, said determining comprising:

initializing the projected area equal to one unit area projected by the second straight edge in one unit step along a major direction across one pixel;

if the second straight edge has a starting point located inside the first pixel, decrementing the projected area by a first excessive area;

if the second straight edge has an end point located inside the first pixel, decrementing the projected area by a second excessive area;

if the second straight edge extends into the first pixel from a second pixel in a same scan line, incrementing the projected area with a carryover area projected by the second straight edge in the second pixel into the first pixel; and

if the second straight edge extends from the first pixel into a third pixel in another scan line in one unit step along the major direction across one pixel, decrementing the projected area by an exceeded area projected by the second straight edge in the third pixel;

determining areas of sub-pixel regions creates by a plurality of third straight edges in a fourth pixel, comprising:

receiving a first fill style to a first side of a third straight edge, a second fill style to a second side of the third straight edge, and a projected area of the third straight edge to the second side of the third straight edge;

incrementing a first parameter by a difference between the second fill style and the first fill style;

if there is a first sub-pixel region having the first fill style in a pixel cell of the fourth pixel:

incrementing a first area of the first sub-pixel region by the difference between one unit area of one pixel and the projected area;

modularizing the first area by one unit area;

if there is not a first sub-pixel region having the first fill style in the pixel cell, saving in the pixel cell a second sub-pixel region having (1) the first fill style and (2) a second area equal to the difference between one unit area and the projected area;

if there is a third sub-pixel region having the second fill style in the pixel cell:

incrementing a third area of the third sub-pixel region by the projected area;

modularizing the third area by one unit area;

if there is not a third sub-pixel region in the pixel cell having the second fill style, saving in the cell a fourth sub-pixel region having (1) the second fill style and (2) a fourth area equal to the projected area;

determining a fill style for a fifth pixel adjacent to the fourth pixel, comprising:

incrementing a second parameter with the first parameter;

filling the fifth pixel with a fill style equal to the second parameter.